

OBITUARY NOTICES OF FELLOWS DECEASED.

JAMES JAGO, B.A. (Cantab.) and M.D. (Oxon.), was a physician of considerable repute in West Cornwall. He was born on December 18, 1815, at the barton of Kigilliack, Budock, near Falmouth, once a seat of the Bishops of Exeter. He was the second son of Mr. John Jago, and the representative of an old Cornish family, who were resident in the parish of St. Erme, near Truro, before the year 1588. One of his lineal ancestors was a staunch Parliamentary, who was appointed a Commissioner of Sequestration by Oliver Cromwell, after the death of Charles I. Young Jago received his early education at the Falmouth Classical and Mathematical School, where he remained a pupil until about 1833. About this time he expressed a strong desire to go through a course of training at one of the Universities, but preparatory to this he had the benefit of some private tuition. He had, however, always a great respect for the instruction he received in the Falmouth School, and he retained a deep interest in its prosperity to the end of his life.

In 1835 Mr. Jago entered St. John's College, Cambridge, as a pensioner, and graduated B.A. in the Mathematical Tripos of 1839 as 32nd Wrangler. Soon after obtaining his degree, he resolved to adopt the medical profession as his future occupation of life. For this purpose, and to obtain the necessary qualifications, he studied at various hospitals in London, Dublin, and Paris. But anxious to obtain a good medical degree, he resolved to go through a special second course of training at the University of Oxford, where he accordingly entered his name as a student, both in arts and medicine, on the books of Wadham College, from which he graduated B.A. and M.B. in 1843, and finally M.D. in 1859.

During the early years of his professional career, after he had chosen Truro for his residence, Dr. Jago was a voluminous writer on various medical subjects, the most important of which were investigations on certain special diseases of the eye. One of his first contributions on this subject, contained in a series of papers published in the 'London Medical Gazette,' is that entitled "Points in the Physiology and Diseases of the Eye." In these papers he developed certain entoptical methods of exploring the eye by means of divergent beams of light, which he considered to be an explanation which preceded all like solutions of the problem. In 1854 he communicated to the Royal Society a paper on "Ocular Spectres and

Structures as Mutual Exponents," which was followed by another on the same subject in 1856. In 1857 a paper "On the Functions of the Tympanum" was also read before the Royal Society. These three papers are published in the 'Proceedings.' Among his other medical papers, which are mostly inserted in the proceedings of kindred societies, or in medical journals, the following titles will give a good notion of Dr. Jago's original investigations. "The Eustachian Tube: why opened in Deglutition?" 1856; "Pains in the Abdominal and Thoracic Walls," 1861; "Ophthalmoscopic Muscæ Volitantes in a very Myopic Eye," 1861; "Medicine as influenced by Scientific Tendencies," 1861; "Entacoustics," 1868; and important papers on "Entoptics," published in the 'British and Foreign Chirurgical Review,' 1859. So much interest was taken in Dr. Jago's papers on Entoptics that he was encouraged to continue his investigations on this subject, which resulted in a publication of a separate treatise in 1864 under the title of 'Entoptics, with its Uses in Physiology and Medicine,' giving not only his own views in some detail, but also those of other writers. This work is an exposition of a difficult subject, especially as the author has ventured on untrodden ground while investigating and suggesting explanations of phenomena which had not hitherto been sufficiently accounted for. Dr. Jago was also a contributor to the 'Journal of the Royal Institution of Cornwall,' which contains his papers "On Observations of the Solar Phenomenon of April 5, 1871;" "Nangitha Cross," with illustrations; and "Ancient Cross at Trelanvean, St. Keverne."

During the last forty years or more, Dr. Jago took a considerable interest in the proceedings of the Royal Institution of Cornwall at Truro. He had served as Honorary Secretary for many years, and in 1873 was elected President for two years. His presidential addresses, delivered at the annual meetings of the Institution, have all been marked as giving the history and progress of Cornish science, and even at the present time may be read with profit. As a Vice-President he continued so long as he was able to take his personal share of work, and his presence on all occasions was always looked upon as certain. Lately, however, owing to his feeble health, he was compelled to retire altogether from any active participation in the management of the Institution. This forced retirement of Dr. Jago from so many of his old associations was much regretted by his friends. He, however, remained a Vice-President until his death, and, though he was unable to attend the meetings, his interest in the proceedings never abated. In 1856, Dr. Jago was appointed Physician to the Royal Cornwall Infirmary, and he was also connected with other medical institutions at Truro. On June 2, 1870, he was elected a Fellow of the Royal Society.

Dr. Jago was married in 1864 to Maria Jones, daughter of Mr.

Richard Pearce, of Penzance, by whom he leaves two daughters. Seven or eight years ago he had an attack of paralysis, which compelled him to retire from practice. He had since been an invalid, getting gradually weaker from year to year, though he was able to take his usual daily drive till within a few days of his death. He died on January 18, 1893, at the age of seventy-seven.

E. D.

The Rev. CHARLES PRITCHARD, D.D., Savilian Professor of Astronomy in the University of Oxford, was born at Alberbury, Shropshire, on February 29, 1808, being the fourth son of Mr. William Pritchard. In his early youth he was sent to a private school at Uxbridge, of which his recollections were slight, but the little that he did remember of its internal and economical arrangements were not pleasant. When nearly eleven years old he was removed to Merchant Taylors' School, to which, according to an entry in Robinson's Registers of the school, he was admitted in January, 1819. In those hardy days it was the custom of the school to commence work at 7 in the morning, and, as young Pritchard's home was at Brixton, he was accustomed, for a year and a half or more, to take this long and weary walk of nearly four miles at a very early hour, regardless of rain or fog. Referring to this period of his schooldays, in his 'Annals of our School Life,' Pritchard says: "I do not remember that I ever complained of this severe arrangement; I was old enough to be aware that temporary economical necessities were the cause, and I can never forget that the words most frequently heard in my home were 'education,' 'education'; so I suppose I felt I was being 'educated.'" Apparently, however, he did not profit so much as he desired from the instruction he received at this school.

From Merchant Taylors' young Pritchard was transferred to an admirable academy at Poplar, conducted by a Mr. John Stock—a self-educated, energetic, and practical man, of very considerable abilities. Here he felt more in his natural element, and he always referred to the practical training he received at this school with the greatest respect. In addition to the general school education usually obtainable at that time, the senior pupils were indulged with the sight and handling of a number of instruments and working models made and used by the celebrated Ferguson, the astronomer. These included some telescopes and quadrants, which excited the curiosity of young Pritchard and other intelligent youths, and probably, in his case, formed the turning-point of scientific proclivities. He has himself said that "very many of us could use the theodolite, and could survey and plot an estate. Our practice-ground was mainly in the Isle of Dogs, at that time an all but unoccupied waste, and I well remember how, at the age of less than sixteen, I earned two guineas

for indoctrinating an intending colonist in the art of field-surveying. I did not leave him until we had completed the plan of Kennington Common, and had calculated its acreage." On leaving this excellent private school, after about two years' tuition, young Pritchard had an opportunity of becoming a private pupil of the Head Master of Christ's Hospital School, who was at that time permitted to take a limited number of private pupils and place them in the public classes under his own personal care. Here young Pritchard attended to his classical studies with great diligence. He was accustomed to recall to his mind, with satisfaction, that, for about a twelvemonth, he was placed at the head of the Deputy Grecians.

Owing to family pecuniary difficulties, arising from the failure of a manufacture conscientiously but unsuccessfully persevered in by his father, young Pritchard was reluctantly withdrawn from Christ's Hospital School. A question now naturally arose in his family as to the future occupation of the youth, who was not yet seventeen years of age, and considered to possess a more than average amount of scholastic knowledge, scientific tastes, and literary abilities. Fortunately, by the advice and intervention of an elder brother, he was permitted to follow his own devices for continuing his education as best he could, with the ultimate hope that means would be found somehow to enable him to enter one of the Universities. "So," he has remarked, "I was left to my own resources, and happily a genuine love of knowledge of any and every sort stirred within my intellectual frame; and, inasmuch as the most attainable form of knowledge for the untutored was, and still is, mathematics, so to mathematics I betook myself with a will."

These two years, 1824—1826, were mostly devoted to self-instruction, and in this interval he made some acquaintance with the contents of Wood's 'Algebra,' Woodhouse's treatise on 'Plane and Spherical Trigonometry,' Dr. Lardner's treatises on 'Analytical Geometry and the Differential Calculus,' and other mathematical works. At the same time he attended some courses of lectures on chemistry, delivered at Guy's Hospital. He was much interested in these lectures, and ever after in the science, the benefit of which was reaped in after years at Clapham. In 1825, when only seventeen, he first felt the ambition of authorship, and published an 'Introduction to Arithmetic,' in which the elementary properties of numbers are explained and demonstrated on the simplest principles. In many respects, these two years turned out to be an important epoch in the life of Pritchard, for by the most determined perseverance in his own studies, and by the assistance of friends and relatives, who engaged to furnish temporarily the requisite funds, he was enabled, soon after Easter, 1826, to enrol his name on the books of St. John's College, Cambridge.

While in residence at Cambridge, Pritchard was fortunate in having the assistance of Charles Jeffreys as his private tutor—an excellent mathematician, and Second Wrangler in Airy's year, 1823. He, from the first, took a good position in the college examinations, and always secured the second place in each year. The practical result of this success was of the highest importance to him, as the accumulation of exhibitions was ultimately sufficient to defray all the necessary expenses of his college education. In the Mathematical Tripos of 1830, Pritchard attained the high position of Fourth Wrangler. He was himself fully satisfied with the result, though it was the general opinion of the college tutors who had watched his career that he had hardly done himself full justice in the examination. His position in the Tripos was, however, sufficient to secure for him a limited number of private pupils, without interfering with his classical studies, to which he now devoted most of his time, as he was unwilling to risk the Fellowship examination, then almost wholly classical. In March, 1832, he attained the height of his ambition, by being elected a Fellow of his college. Pupils now flocked to him in superabundance, and appearances seemed to indicate that he was destined to settle down as a resident Fellow, and take an active share in the public tuition of his college. But other circumstances soon arose, preventing any arrangement of this kind. Some scholastic employment having been offered to him in connexion with a new proprietary school in London, he determined to forego his University prospects, and to seek his fate in the larger world of the metropolis. Writing more than fifty years afterwards, on referring to this important crisis in his life, he remarked that "looking back now through the vista of half a century, I cannot wholly satisfy my mind as to all the motives which impelled me, at so early a period of a successful academical career, to relinquish the natural hopes and ambitions which must have legitimately presented themselves. It might have been impatience. But still, looking back through the busy occupations of many subsequent years, I am inclined to doubt if I could have occupied them more advantageously in any other rôle of life than that in which I have actually engaged."

When still an undergraduate, Pritchard's originality of thought often induced him to consider other mathematical questions than those required in the college examinations. He was especially interested with certain trigonometrical relations brought to light by the mathematician Poincot, which led him to examine other writings of the same author, more particularly his treatise on the 'Theory of Statical Couples.' Pritchard became quite enamoured with the singular power and wide application of the theory, and also with the clear light that Poincot had thrown on much that had hitherto been obscure in the theory of mechanics. He has said with enthusiasm:—

"I could not rest until I had simplified the subject and brought my joy and my light within the ken of others." His interest in Poinso's work resulted in the publication of a little treatise on the 'Theory of Statical Couples,' which was sufficiently popular to run through two editions, and to be adopted in the general University teaching. About the same time he contributed to the Cambridge Philosophical Society a paper on "The Figure of the Earth," consisting of a simplification of the final propositions in the mathematical treatment of the Earth, considered as heterogeneous.

In 1833 Pritchard accepted the post of Head Master of a new proprietary school at Stockwell—one of those founded about that time in the suburbs of London under the auspices of King's College. The tenure of this office was, however, in no way an agreeable one, for, from the date of his appointment, his relations with a minority of the Committee were unfortunate. The school flourished numerically, notwithstanding the ceaseless interference and sundry small annoyances to which he was subjected. As time went on, these personal differences increased, until they became so unbearable to Pritchard that in June, 1834, he resigned his office, and had serious thoughts of returning once more to the more peaceful occupation of a University life. But, owing to the prospect of an early marriage, by which his Fellowship would be vacated, and finding that some of the leading men in Clapham, and also many of the parents of his pupils, had expressed a strong desire for the establishment of a new school under better and more liberal regulations, he, after some consideration, consented to superintend such an institution. On this basis the well-known Clapham Grammar School was founded in August, 1834.

In this school Pritchard continued to be the central and controlling spirit during the following twenty-eight years, labouring in the cause of high middle-class education with untiring energy and success, by which he obtained very rapidly a high reputation as a successful teacher. The many schemes he devised during this period for the thorough training of his numerous pupils have been highly appreciated. Some of them have been adopted with advantage in other schools. In an article contained in the 'Nineteenth Century' for March, 1884, the Dean of Westminster, Dr. Bradley, who received his early education at Stockwell, and afterwards at Clapham, bears personal testimony to the enlarged and generous views of his old teacher. The article gives a most interesting description of the early days of the school, and of the practical methods employed by Pritchard to interest the boys in their studies:—"He, first of all, at a time when the real study of comparative philology was almost unknown in England, gave us some glimpses into what I may call the science of language; he taught us to try to group together facts for ourselves, and to form laws from what we observed and met.

And he did more, he taught us something at the same time of the beauty and charm of literature, old and new. But this was not all; no single week passed in which we did not receive and eagerly look forward to at least one lesson in natural science. Heat, elementary hydrostatics, mechanics, optics, electricity, and, above all, chemistry—to something of the elements of all these we were introduced in turn. Meantime we were led through stage after stage of the severe discipline of mathematical study. I felt then, as I feel now, that even the study of mathematics was coloured with the warm glow of the activity and originality of the teacher's mind."

The reputation of the Clapham Grammar School was sufficient to attract pupils from all parts of the kingdom. One important feature was the interesting fact that among them might be found the sons of distinguished men at the head of the several branches of science, and of the liberal professions. The names of Airy, Barry, Darwin, Gassiot, Grove, Hamilton, Herschel, Maurice, and others, became familiar in the roll-call. For reasons possessing only a personal interest, Pritchard brought his Clapham life rather suddenly to a close in the year 1862, when he transferred all his interests in the school to Dr. Alfred Wrigley, one of the Professors at Addiscombe. He then retired, with his family, to Freshwater, Isle of Wight, where he hoped to enjoy a few years' repose, intending afterwards to apply himself to the permanent duties of some pastoral charge.

Pritchard was of far too active a mind to remain long in retirement. For some time his ambition seems to have been directed to some preferment in the Church, but his hopes were doomed to disappointment. He always considered himself to be a divine in mind and heart, though, by the force of circumstances, he became first a schoolmaster and then a professional astronomer. It has been stated by one of his late assistants that, "so anxious was he for a cure of souls, that he applied to one of his old pupils, who was then a Bishop, and asked for a living of only £100 a year. He was refused, and felt the refusal keenly." In some form or other he was, however, frequently engaged in clerical work during his seven or eight years of retreat. On several occasions he was invited to preach before the British Association at the annual meetings, first at Nottingham in 1866, and afterwards at Dundee in 1867, Norwich in 1868, Exeter in 1869, and Bristol in 1876. He also delivered addresses, generally on the harmony of the Bible and science, at various Church Congresses. Vice-Chancellor Page Wood, afterwards Lord Chancellor Hatherley, to whom Pritchard alludes as "the friend of his life," was much impressed with the treatment of the subject in the Nottingham sermon, and was induced to write a short treatise on the 'Continuity of the Holy Scriptures,' based on the same line of argument adopted by Pritchard. This celebrated sermon led to his appointment as Hulsean Lecturer

at Cambridge in 1867. He was one of the Select Preachers at Cambridge in 1869, and at Oxford in 1876 and 1877.

Pritchard's occupations during his residence at Freshwater were not by any means confined to clerical duty, as for some time before and after he left Clapham he felt much personal interest in the affairs of the Royal Astronomical Society, and in astronomical researches generally. The first paper contributed by him to the Society, bearing upon the practical part of astronomy, is contained in the 'Monthly Notices' for January 14, 1853, giving an account of some experiments towards increasing facility and certainty in the use of mercury in observations by reflexion, and for the adjustments of astronomical instruments. In 1856 he became a member of the Council, and shortly afterwards read a paper, the result of considerable calculation, on "The Conjunctions of the planets Jupiter and Saturn in the years B.C. 7, B.C. 66, and A.D. 54." This memoir was written to correct an astronomical error in which Ideler and others had fallen, while attempting to establish the date of the true *Annus Domini*. Astronomy, indeed, was not neglected at Clapham, for an observatory, furnished with an equatorial and a transit instrument, was actually added to the other institutions of the school, and Pritchard built another observatory for his private use at Freshwater. This long personal interest in astronomical research as an amateur led to his appointment, in 1862, to the responsible post of Honorary Secretary of the Royal Astronomical Society, and, subsequently, to that of President for two years, 1866—1868. His zeal for the interests of this Society and the promotion of astronomy was so great that, though resident in the Isle of Wight, he made it his duty to be present at most of its meetings. It is a pleasing record of scientific devotion to state that, during his two years' tenure of the Presidency, he was able to preside over the ordinary meetings fourteen out of a possible sixteen times. His addresses delivered at the anniversary meetings of the Society, on presenting the Gold Medal to the medallists of 1867 and 1868, are not only models of elegance of language, but they are also masterly expositions of both the new and old astronomy, in connexion with those sections of the science for which the Medals were respectively awarded: that of 1867 to Huggins and Miller for their joint researches in astronomical physics; and that of 1868 to the great French astronomer Le Verrier for his sublime mathematical investigations on the planetary theories, and the construction of new tables of the motions of Mercury, Venus, the Earth, and Mars in their orbits.

By the death of Professor Donkin in November, 1869, the Savilian Professorship of Astronomy at Oxford became vacant. Candidates from all parts of the world were eligible, and the appointment of a new Professor was at that time in the hands of thirteen trustees, in-

cluding Pritchard's friend, Lord Chancellor Hatherley. No one knew more than Sir John Herschel of the qualifications of Pritchard to fulfil the required conditions necessary for giving sound instruction on theoretical and practical astronomy. It was, therefore, by Sir John's urgent recommendation, together with the advice of other leading Fellows of the Royal Astronomical Society, that the Lord Chancellor was prevailed upon to exercise his great influence in his favour. No doubt this high patronage had its value, for at a meeting of the trustees, held early in 1870, he had the good fortune to be elected Savilian Professor of Astronomy.

Now comes a remarkable example of the intellectual strength and energy of Pritchard's character. At the date of his appointment he had reached the age of sixty-two, and, at the same time, had had very little personal experience of the practical work required in a large observatory. Most people of his age and habits, after having passed a busy life, are naturally looking forward to some relief from their ordinary daily occupations; or, at any rate, they are generally desirous to maintain, in any new official position, some conservatism of ideas and methods. But this was in no way the case with Professor Pritchard, who at once resolved that his Professorship was to be no sinecure for him; but that, on the contrary, he felt sure that some instrumental means would be found to enable him to contribute his share towards the progress of some of the most delicate problems in astronomical physics. To effect this, however, a new University Observatory would be required, and how this could be accomplished was for some time the principal subject that occupied his thoughts. In due time he laid his proposition before the governing authorities of the University, requesting that the Savilian Professor should be provided with astronomical instruments adequate to the instruction of his class and for the purposes of original research. The formal application was made to Convocation in March, 1873, when a liberal sum of money was granted, sufficient for the purchase of a refracting telescope of $12\frac{1}{4}$ inches aperture, and for erecting a suitable building to contain it. This grant was soon afterwards supplemented by Dr. Warren De La Rue's munificent gift of his 13-inch reflecting telescope, and many other valuable astronomical instruments, formerly belonging to his private observatory at Cranford. Thus, before the end of 1875, the University Observatory was completed, fully equipped and ready for active work for the promotion of the study of practical and philosophical astronomy.

It is not possible to find space in this notice for an adequate description of the numerous contributions to astronomical physics emanating from the labours of Professor Pritchard and his two assistants. With instruments of the most modern construction, they have been able to accomplish much that is new in some of the most

delicate branches of astronomical observation, without intrenching on the regular work of other official observatories. The results have been mostly printed in the 'Memoirs' and 'Monthly Notices of the Royal Astronomical Society,' or in the 'Proceedings of the Royal Society,' to which reference should be made for the details of the separate researches. Of the fifty papers chiefly contributed to these Societies since 1870, it will suffice, here, to give the titles only of a few of the most important: "On the Moon's Photographic Diameter, and on the Applicability of Celestial Photography to accurate Measurement"; "On a simple and practicable Method of measuring the Relative apparent Brightnesses or Magnitudes of the Stars with considerable accuracy"; "On certain Deviations from the Law of Apertures in relation to Stellar Photometry, and on the Applicability of a Glass Wedge to the Determination of the Magnitudes of Coloured Stars"; "On the Parallax of 61 Cygni, as obtained by the aid of Photography"; "Photometric Determination of the Relative Brightness of the Brighter Stars North of the Equator"; "Uranometria Nova Oxoniensis," containing the relative magnitudes of 2,784 stars, determined by the wedge-photometer; "On the Relative Proper Motions of 40 Stars in the Pleiades"; "On the Capacities, in respect of Light and Photographic Action, of two Silver on Glass Mirrors of different Focal Lengths"; "Determination of the Parallax of 30 Stars, chiefly of the Second Magnitude, by the Photographic Method," &c. Professor Pritchard also undertook a share of the observations for the new International Photographic Chart of the Heavens. The special zone of six degrees between 31° and 25° N. declination has been allotted to the Oxford University Observatory, and, at the time of his death, some progress in the work had been made.

In addition to the astronomical researches carried on under Professor Pritchard's direction, some most excellent papers and treatises of a popular nature were written by him from time to time. Not the least interesting are the three *éloges* contributed to the 'Annual Reports of the Royal Astronomical Society' for 1865, 1866, and 1872, on the deaths of F. G. W. Struve, Director of the Pulkowa Observatory, Sir W. Rowan Hamilton, and Sir John F. W. Herschel. He wrote a series of popular articles on astronomy for 'Good Words,' and was the author of "The Star of the Magi" in the 'Biblical Dictionary,' and of several articles in the ninth edition of the 'Encyclopædia Britannica.' He also collected some of his miscellaneous writings into a volume entitled 'Occasional Thoughts of an Astronomer on Nature and Revelation.'

His Savilian Lectures, both on theoretical and practical astronomy, were usually well attended, especially by intending candidates for mathematical honours. Owing to constant and increasing applica-

tions of University students for practical instruction, he provided a subsidiary observatory on the roof of the lecture room for their special use. Recently he erected a more convenient building, which he furnished with some excellent instruments. Every accommodation was thus provided for the instruction of the students, without in any way interfering with the larger instruments reserved solely for research.

Professor Pritchard proceeded to the degree of M.A. (Cantab.) in 1833, M.A. by decree (Oxon.) in 1870, and B.D. and D.D. in 1880. He was ordained Deacon in 1833, and Priest in 1834. On taking up his residence at Oxford, he attached himself to New College, of which, as Savilian Professor of Astronomy, he became a Fellow in 1883. He was elected, in 1886, an Honorary Fellow of St. John's College, Cambridge—an honour he greatly esteemed. He was a Fellow of the Royal Society for more than half a century, having been elected so long ago as February 6, 1840. He served on the Council two years, from November, 1885 to 1887, and at the Anniversary Meeting held on November 30, 1892, he was presented with one of the Royal Medals for his successful labours on photometry and stellar parallax. He was elected a Fellow of the Royal Astronomical Society on April 13, 1849, and was a continuous member of the Council from 1856 to 1877, and from 1883 to 1887. In 1886 he was awarded the Gold Medal of that Society for his 'Photometric Researches.' He was also a Fellow of the Geological Society and the Cambridge Philosophical Society. As Savilian Professor of Astronomy, he was an *ex-officio* member of the Board of Visitors of the Royal Observatory, Greenwich.

The great age to which Professor Pritchard attained never interfered with his determination to make the University Observatory a first class institution. His mental faculties were unclouded to the end; he was always able to keep abreast with the newest problems in the physics of astronomy, and it was a frequent and pleasing sight to witness the venerable astronomer enter into the depths of a technical discussion, with all the interest and energy of youth. In the midst of his scientific and University career, he did not, however, forget the busy time he had passed with his pupils in his old school at Clapham. In 1886, soon after he had received both scientific and college honours, it was a great joy to him to receive an invitation to a complimentary banquet at the Albion, Aldersgate Street, from his "Old Boys," among whom grisly beards and grey heads predominated. An interesting result of this social meeting of his old pupils, presided over by the Dean of Westminster, was a small volume, written by him for private distribution, full of pleasing reminiscences of his former school life.

Professor Pritchard was twice married :—(1) at Lambeth, on December 18, 1834, to Emily, fifth daughter of J. Newton, Esq.; and

(2) at St. Peter's, Croydon, on August 10, 1858, to Rosalind, daughter of Alexander Campbell, Esq., of Tunbridge Wells. His second wife predeceased him about a year. During the later years of his life, though naturally feeling the increasing weakness of old age, his health continued fairly good almost to the end, while the daily work of the Observatory never ceased to occupy his thoughts. He was fond of botany, and was a great lover of floriculture of the highest order. At one time he was supposed to possess one of the best collections of ferns in England. This love of flowers and plants continued as a pleasant recreation. It was only a week before he passed away that he was pointing out to a friend, with conscious pride, the beauty of the garden he had created around the Observatory. His death took place on the morning of Sunday, May 28, 1893, in the eighty-sixth year of his age; and on the following Wednesday afternoon his remains were laid to rest in Holywell Cemetery, Oxford.

E. D.

HENRY FRANCIS BLANFORD was born June 3, 1834, in Bouverie Street, Whitefriars, London, where his father, William Blanford, carried on a manufacture of gilt mouldings for decorative purposes, picture frames, &c., in premises now converted into the printing offices of the 'Daily News' newspaper.

The subject of the present memoir received his early education at schools in Brighton and Brussels, and after studying for some time at the School of Design, first in Somerset House, then in Marlborough House, he entered the Royal School of Mines, in Jermyn Street, at its commencement in 1851. At the School of Mines, he took the first place of the year, and at the conclusion of the first year's term, received the only prize then offered, the Duke of Cornwall's Scholarship. After leaving the school, he passed a year in studying mining at the Bergakademie of Freiberg, and another year, part of which he employed in translating v. Kobell's book on the blowpipe, his first published work, in London.

In 1855, Mr. Blanford and his brother, also a School of Mines student, received appointments on the staff of the Geological Survey of India, under the late Dr. T. Oldham, and they arrived in Calcutta at the end of September. Shortly after, the two brothers and Mr. W. Theobald, another member of the staff, were despatched to Orissa, to report upon a coal-field around Talchir, in the wild tract of the Tributary Mehals. Of this coal-field nothing except the existence of coal was known at the time; the whole of the geology had to be made out from the examination of the ground, the greater part of which was covered with forest. It was under these circumstances that, mainly through the observations of Mr. H. F. Blanford, the first steps were taken towards the classification of the remarkable series

of deposits associated with the Indian coal-bearing beds, by the separation of the underlying or Talchir division, and of an overlying group, from the true coal measures, subsequently called, by Dr. Oldham, the Damuda beds.

For some time Mr. H. F. Blanford was engaged in Calcutta, in charge of the Survey Office, and in palæontological work in the museum, but in 1857 he was placed at the head of a large survey party that was despatched to Madras, and he was chiefly engaged for the next three or four years in examining the cretaceous beds near Trichinopoly and Pondicherry, some fossils from which, described by Professor E. Forbes, Sir P. Egerton and Mons. A. d'Orbigny, had attracted much attention. The stratigraphy and the distinction of the different divisions in the field were founded on palæontological evidence, and the classification established by Mr. Blanford was fully confirmed by Dr. Stoliczka's subsequent exhaustive description of the fauna. A commencement of this description was made by Mr. Blanford himself, who, before he left the Indian Geological Survey in 1862, published an account of the Nautilidæ and Belemnitidæ in the '*Palæontologia Indica*.' The geology of the area was described by him in the Memoirs of the Survey, to which he also contributed an account of the Nilgiri Hills.

Mr. Blanford's retirement from the survey was due to various causes, amongst which was the injury to his health produced by the exposure to the climate entailed by geological surveying. Soon after leaving India he was offered the Science Professorship in the Presidency College, Calcutta, by the late Mr. W. Atkinson, at that time Director of Public Instruction in Bengal. This appointment Mr. Blanford accepted, and after spending some months in Europe to recruit his health, he joined the staff of the Bengal Educational Department towards the end of 1862. He became, in 1864, one of the hon. secretaries of the Asiatic Society of Bengal, and about the same time, partly in consequence of his duties as secretary, his attention was directed to meteorology.* On October 5th, 1864, Calcutta was visited by one of the most destructive cyclones on record; a storm-wave rushed up the Hooghly River, and flooded the neighbouring low lands; upwards of 40,000 human beings were drowned, and a great part of the shipping in the river was wrecked. This cyclone was followed within a few weeks by another, which passed over Masulipatam, and the storm-wave again caused the loss of about 30,000 lives. These startling disasters naturally aroused the attention of the Indian Government and the public generally to the necessity of systematic meteorological observations, and to the im-

* The account of Mr. Blanford's meteorological work is by Mr. J. Eliot, his successor as Meteorological Reporter to the Government of India.

portance of establishing a proper system of storm-warnings for the protection of the ports of India, and especially Calcutta.

Up to the date mentioned almost the only trustworthy records of meteorological observations in India were those which had been kept for several years at the observatories of Madras and Bombay, and at the Surveyor-General's office in Calcutta. It is true that observations were also taken at a number of hospitals and dispensaries throughout India; but the instruments had not been verified, the observers were untrained, and there was no proper supervision; moreover no care had been taken to preserve the records. Mr. H. Piddington had collected and published in the '*Journal of the Asiatic Society of Bengal*,' details of 23 different cyclones in the Indian and Chinese Seas, a work of the greatest interest and value, but the data, which were naturally imperfect, whilst adding greatly to the knowledge of these storms, and whilst sufficing to enable Mr. Piddington to frame practical directions for the guidance of sailors during such storms in the India seas, had not led to a full understanding of the disturbances, or of their origin.

At the instance of General (then Colonel) R. Strachey, who, in 1857, called the attention of the Asiatic Society to the uselessness of the desultory attempts that had up to that time been made to acquire a knowledge of Indian meteorology, and to the urgent need of some controlling authority capable of directing and utilising the work of observers in India, a committee was formed which, after some unsuccessful attempts at acting as a controlling power, drew up, in 1862, a report in which the establishment of a small centralized system by the Government was recommended. At the request of the Government, the Committee, after some delay, drew up a scheme for carrying out the system recommended. This was not submitted to the Government till 1865, after the occurrence of the Calcutta and Masulipatam cyclones. Meantime the Indian Government had been urged by the Lieutenant-Governor of Bengal to establish a system of storm warnings, and the Secretary of State, about the same time, recommended the record of meteorological data in connection with the suggestions and requirements of the Sanitary Commission. To the latter body the whole question of meteorological enquiry in India was referred, and in accordance with their recommendations, provincial meteorological systems were established in the Punjab and North-West Provinces in 1865, in Madras in 1866, and in Bengal in 1867. These systems were, however, quite independent of each other, and the opportunity of establishing a controlling authority, so emphatically urged by General Strachey and the Calcutta Committee, was postponed for several years.

An account of the Calcutta cyclone of 1864 was drawn up by Colonel Gastrell and Mr. Blanford, and was published by order of the

Lieutenant-Governor of Bengal in 1866. It gave a very full description of all the more important features of that cyclone, and, considering the unsatisfactory character of a large portion of the data, is remarkably complete. The conclusions based on the data and on the investigations of Piddington show a thoroughly clear grasp of the subject, and are, in almost every respect, in agreement with the results of later investigation on storm genesis and motion in India.

Soon after the Calcutta cyclone, at the instance of the Lieutenant-Governor, a Committee, of which Mr. Blanford was the secretary, was appointed to arrange a system of storm-warnings for the port of Calcutta. Observatories were established at a number of coast stations, and the observations made were telegraphed to Calcutta daily. The Bengal Provincial Meteorological Department was founded in 1867 for the combination of general meteorological observations with the continuation of this system of storm-warnings, and Mr. Blanford became Meteorological Reporter for Bengal, still retaining his Professorship, and lecturing, chiefly on chemistry and physics, in the Presidency College. The new Meteorological Department of Bengal at once took a very high position, and became known for the accuracy of its data and the thoroughness of its work, and the annual reports on the meteorology of Bengal, prepared by Mr. Blanford, increased in importance from year to year. He also, during the eight years that he held the post, published a series of meteorological papers in the 'Journal of the Asiatic Society of Bengal.' Of these the most important were "On certain protracted irregularities of Atmospheric Pressure in Bengal in relation to the Monsoon Rainfall" ('Jour. As. Soc. Bengal,' vol. 39, Part 2, p. 123); "On the Normal Rainfall of Bengal" (*i.e.*, p. 243); and "On some recent Evidence of the Variation of the Sun's Heat" ('J.A.S.B.,' vol. 44, Part 2, p. 21). The first of these papers directed attention to one of the more important features of Indian meteorology, and, probably, of tropical meteorology in general, the frequent persistency of abnormal variations of pressure over large areas in India for periods varying in length from a few months to two or three years, and the connexion between such prolonged abnormal features and large modifications in the distribution of rainfall. This was a subject which occupied much of Mr. Blanford's thoughts, and it is increasing in importance in connexion with the forecasting of the general character of the monsoon rains, now performed by the Indian Meteorological Department.

During the same period he contributed two papers, one "On the Origin of a Cyclone" ('Proc. Roy. Soc.,' vol. 17, 1869, p. 472), the other on "The Winds of Northern India" ('Phil. Trans.,' vol. 166, p. 563), to the Royal Society. In the second paper he utilised the data collected by the Meteorological Departments of Bengal, the North-Western Provinces, and the Punjab, in order to describe the

chief features of the normal air-currents over Northern India, and to trace out their origin and causes, so far as they could be discovered, in the local physical changes of the atmosphere. The broad features were skilfully worked out, and the relations of the north-east and south-west monsoon currents to each other, and to the temperature and other conditions of India, clearly shown. This paper was particularly interesting. Not only was it the first attempt to discuss this important question by the aid of fairly accurate data, but it was also the first essay on Indian meteorology as a whole, and the subject was for the first time treated as a problem of dynamic meteorology, and recent extensions of knowledge in the physical sciences utilised in the discussion of the various problems.

Shortly after the publication of this important paper the Government of India came to the conclusion that the provincial system without a central controlling authority was unsatisfactory and ineffective, and it was determined to constitute a centralised department on the lines laid down as essential by General Strachey some years previously. Mr. Blanford was, in 1874, in consequence of this change of system, transferred from the Educational Staff of Bengal, and appointed head of the new department. He was called upon, at the time of his appointment, to prepare a scheme for the reorganisation of the provincial meteorological systems and their consolidation into an imperial system, with himself, the Meteorological Reporter to the Government of India, as central controlling authority.

In the scheme drawn up, Mr. Blanford sketched first the general principles on which meteorological work should be carried out in India, and also made proposals for the extension of the work of observation and for the centralisation of the Department, in order to secure uniformity of methods and tabulation of the results. He also proposed the commencement of special series of observations to throw light on the regular diurnal and annual meteorological changes in India. The scheme was approved in its entirety, and brought into operation in the year 1875. It has stood the test of time thoroughly, and the Department has developed during the eighteen years of its existence in the directions fully anticipated by Mr. Blanford.

One of the first important labours of the Meteorological Reporter to the Government of India was to write the 'Indian Meteorologist's Vade Mecum.' This was primarily intended to inform the observers at Indian observatories what and how they were to observe, in order that their observations might be accurate and useful. This portion of the work forms Part I of the 'Vade Mecum.' In order to arouse an intelligent interest in their work, Mr. Blanford, in Part II, gave an interesting account of all the more important features of Indian meteorology so far as then known, together with explanations based on the data and ideas of recent advances in physical science. The 'Vade Mecum' at

once became a useful book of reference for Indian observers, and was practically the first treatise which placed the ideas of the modern school of dynamical meteorology in an easily accessible form before ordinary readers. It was for many years the best treatise on modern meteorology, and was the forerunner of the numerous treatises on the science which have been published in the United States, Germany, and England.

Mr. Blanford was Meteorological Reporter to the Government of India from 1874 to 1889, but during the last two years he was on furlough. During this period he wrote a number of short and valuable papers for the Asiatic Society's Journal, of which the following were the most important: "On the High Atmospheric Pressure of 1876-78 in Asia and Australia, in relation to the Sun Spot Cycle" ('Jour. As. Soc. Bengal,' vol. 49, Part 2, p. 70; 1880); "On the Relations of Cloud and Rainfall to Temperature in India, and on the opposite Variations of Density in the Higher and Lower Atmospheric Strata" ('J.A.S.B.,' vol. 50, Part 2, p. 69; 1881); "The Theory of the Winter Rains of Northern India" ('J.A.S.B.,' vol. 53, Part 2, p. 1; 1884), and a series of papers on the "Diurnal Oscillation of the Barometer."

During the same period he wrote a very important short paper for the Royal Society "On the Connection of the Himalaya Snowfall with Dry Winds and Seasons of Drought in India" ('Roy. Soc. Proc.,' vol. 37, 1884, p. 3). In this he dealt with a remarkable feature of Indian meteorology, viz., the effect of abnormally heavy snowfall in the Himalayan area in modifying the pressure and temperature conditions over Northern India during the hot weather, and hence the distribution of rainfall during the following south-west monsoon. He was the first to realise fully the importance in Indian meteorology of this factor which has become the basis for the seasonal forecasts now issued by the Indian Meteorological Department.

His most important work at this time was undoubtedly the series of annual reports on the meteorology of India (from 1876 to 1885) that he wrote, and the papers he contributed to the 'Indian Meteorological Memoirs,' which publication he initiated shortly after the establishment of the Indian Meteorological Department.

The subjects of these papers show how largely his mind was occupied with the regular diurnal and annual meteorological changes in India. He considered a full knowledge of these matters of primary importance in the present stage of our knowledge, and that their solution would throw valuable light on some of the most important abnormal features of Indian meteorology and might furnish a key for the explanation of these features.

His last and most important work of investigation was the monograph on "The Rainfall of India" ('Indian Meteorological Memoirs,'

vol. 3). It was the outcome of the labour of several years. All the available data were obtained and sifted to separate the doubtful from the trustworthy. The result of this investigation was to give an accurate knowledge of all the broader features of the distribution of the rainfall of India, and of the chief causes or factors (physical and topographical) determining the law of its distribution.

After he retired on pension in 1889 he continued to devote himself with unwearied zeal amidst failing health to the discussion of his favourite meteorological problems. He undertook the discussion of the series of hourly observations taken at about twenty-five stations in India from 1876 to 1888. He completed the discussion of those taken at Sibsagar, Dhubri, Goalpara, Hazaribagh, Patna, Roorkee, and Allahabad, but was obliged to give up the work in the beginning of 1892. It was his intention to have prepared separate statements and brief discussions of the results for each station, and to have followed this up with a general discussion of the whole of the results, and it is greatly to be regretted in the interests of meteorological science that he was not spared to complete this work on a subject to which he had devoted especial attention, and which he was especially qualified to investigate.

He presented the chief results of his investigations and those of his co-workers in India to the English public in 1889, shortly before his death, in his 'Climates and Weather of India.' It is a valuable work of local climatology, and presents all the more important results of the work of the Meteorological Department during his *régime* in an interesting form for English readers.

It will thus be seen that his life was one of unwearied activity. His powers of organisation were shown by the steady development of the department which he established and initiated. He was a patient and vigorous worker, and the results of his labours are shown as much by the numerous short suggestive papers he contributed to various Societies, &c., as by his larger monograph 'On the Rainfall of India,' and the Annual Reports on the Meteorology of India. His name will be associated with the commencement and development of scientific meteorology in India, and the rapid growth of the department under him is the best proof of his special qualifications as a meteorologist and of his zeal and untiring energy. European meteorologists recognised almost from the first the value of the work done by the department under him; it was his constant aim to place his department upon as high a level for scientific and practical work in meteorology as similar departments in Europe and America, and it is hardly too much to say that he fully succeeded.

After he became engaged in the work of Indian meteorology, Mr. Blandford's time was almost entirely occupied with that subject, although he by no means lost his interest in geology and zoology.

His only important contribution to Indian geology after he left the Indian Survey, was a paper published by the Geological Society in 1875, 'On the Age and Correlation of the Plant-bearing Series of India and the former existence of an Indo-Oceanic Continent.' He also contributed a few short papers to Indian scientific societies on land and fresh-water mollusca and on ferns. He was the author of two treatises on the geography of India, one of which has now for many years been used as a text-book in Indian schools and colleges, and the other, a recent publication, forms one of Macmillan's geographical series. Mr. Blanford married, in 1867, the daughter of Mr. G. F. Cockburn, of the Bengal Civil Service, and leaves a widow, one son, an officer in the Royal Artillery, and three daughters. He was elected a Fellow of the Royal Society in 1880, and was President of the Asiatic Society of Bengal in 1884-85. His health had been precarious for some time before he retired from the Indian Service, and he died of cancer at Folkestone, where he had resided after his return to England, on the 23rd January of the present year.

W. T. B.

Dr. WILLIAM CHARLES HENRY was born in Manchester, March 31, 1804. His father and grandfather were both Fellows of this Society, and both distinguished chemists. He was educated at various schools, and matriculated at Edinburgh University in November, 1824. In 1827 he graduated M.D., the subject of his graduation thesis being "De Tuberculorum Origine," and in the following winter studied in the Paris hospitals, attending as well the lectures at the Sorbonne. From 1828 to 1835 he was physician to the Manchester Royal Infirmary, but resigned this post in order to continue his chemical studies. He studied at Berlin and Giessen, and afterwards returned to Manchester. Leaving Manchester about 1842, he took up his residence at Ledbury and remained there until his death on January 7, 1892.

Dr. Henry was elected a Fellow of the Royal Society in 1834; he was also a Fellow of the Chemical and Geological Societies, and a Corresponding Member of the Royal Academy of Sciences at Turin. He was the author of papers "On the Relation existing between Nerve and Muscle" ('Roy. Soc. Proc.,' 1831, p. 64), "On the Physiology of the Nervous System" ('Brit. Assoc. Rep.,' 1833), "On the Atomic Constitution of Elastic Fluids" ('Phil. Mag.,' 1834), "On the Action of Metals in determining Gaseous Combination" ('Phil. Mag.,' 1835), "On Gaseous Interference" ('Brit. Assoc. Rep.,' 1836), and was the author of "Memoirs of the Life and Scientific Researches of John Dalton" (Cavendish Society, 1854), Dalton having been one of his most intimate friends.

M. F.